TECHNICAL MANUAL

CALIBRATION PROCEDURE

FOR

DIGITAL RADIO TEST SET

3920 OPT 053, 058

(AEROFLEX WICHITA INC.)

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DIGITAL RADIO TEST SET

3920 OPT 053, 058

(AEROFLEX WICHITA INC.)

1 CALIBRATION DESCRIPTION:

Table 1.

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Frequency		
Time Base	Range: 10 MHz Accuracy: Accuracy: ±1 X 10^{-7}; *1 Aging/year: ±1 X 10^{-7}; Temperature: ±1 X 10^{-8} (0 to 50 ºC) *2	Compared to a Frequency Standard
Signal Generator		
Frequency	Range: 10 MHz to 1.05 GHz; 10 MHz to 2.7 GHz (OPT 058) Resolution: 1 Hz Accuracy: ±(Timebase + 1 LSD)	Implicitly verified during Time Base Calibration
Output Level	Range: (3920 and 3920N) T/R: -130 to -30 dBm; Duplex: CW or FM, -130 to +10 dBm; (+10 dBm max for CW or FM, 0 dBm max for Complex Modulation) Accuracy: ±1 dB, >-110 dBm Range: (3920B) T/R: -130 to -30 dBm; (-30 dBm max for CW or FM, -35 dBm max for AM, -40 dBm max for Complex Modulation); Duplex: -130 to +10 dBm; (+10 dBm max for CW or FM, +5 dBm max for AM, 0 dBm max for Complex Modulation) Accuracy: ±1 dB, >-110 dBm; ±1.5 dB, ≤-110 dBm	Measured with a Power Meter and Power Sensor and Microwave Measurement Receiver

See footnotes at end of Table.

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Signal Generator *(Cont.)*		
Spectral Purity		
Harmonics	Range: 10 MHz to 1.05 GHz; 10 MHz to 2.7 GHz (OPT 058) Accuracy: (+10 dBm output level) <-25 dBc	Measured with a Power Meter and Power Sensor and Microwave Measurement Receiver
Non-Harmonics	Range: 10 MHz to 1.05 GHz; 10 MHz to 2.7 GHz (OPT 058) Accuracy: <-55 dBc at all freq except crossovers; *[3] <-35 dBc at crossover freq *[3]	
Residual FM	Range: 10 MHz to 1.05 GHz; 10 MHz to 2.7 GHz (OPT 058) Accuracy: (Post Detection BW = 300 Hz to 3 kHz) <15 Hz rms (3920 and 3920N); <5 Hz rms (3920B)	Measured with Microwave Measurement Receiver
Phase Noise	Range: 10 MHz to 1.05 GHz; 10 MHz to 2.7 GHz (OPT 058) Accuracy: (20 kHz offset): <-93 dBc/Hz, <1.05 GHz (3920 and 3920N); <-90 dBc/Hz, >1.05 to 2.7 GHz (3920 w/OPT 058 and 3920N w/OPT 058); (10 kHz offset): <-110 dBc/Hz, <500 MHz (3920B); <-106 dBc/Hz, ≤1 GHz (3920B); <-95 dBc/Hz, >1 GHz (3920B and 3920B w/OPT 058)	
Residual AM	Range: 10 MHz to 1.05 GHz; 10 MHz to 2.7 GHz (OPT 058) Accuracy: (Post Detection BW, 300 Hz to 3 kHz) <0.1% rms	

See footnotes at end of Table.

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Signal Generator *(Cont.)*		
Frequency Modulation		
Deviation	Range: Off, ±1 Hz to ±150 kHz; Rate: 20 Hz to 15 kHz (3920); 20 Hz to 20 kHz (3920B and 3920N); Resolution: 1 Hz Accuracy: (±1 to ±100 kHz dev, 20 Hz to 15 kHz rate) ±3% of setting	Measured with Microwave Measurement Receiver
Distortion	Range: 10 MHz to 1.05 GHz; 10 MHz to 2.7 GHz (OPT 058) Accuracy: (1 kHz rate, 6 kHz deviation, 300 Hz to 3 kHz BW) <1% THD	
Amplitude Modulation		
Depth	Range: 0 to 100 %; Rate: 20 Hz to 15 kHz (3920); 20 Hz to 20 kHz (3920B and 3920N); Resolution: 0.1% Accuracy: (10 to 90%, 20 Hz to 15 kHz rate) ±1% AM	
Distortion	Range: 10 MHz to 1.05 GHz; 10 MHz to 2.7 GHz (OPT 058) Accuracy: (1 kHz rate, 30 to 70% AM, 300 Hz to 3 kHz BW) <1% THD	

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Receiver		
Frequency	Range: 10 MHz to 1.05 GHz; 10 MHz to 2.7 GHz (OPT 058); Resolution: 1 Hz Accuracy: ±(Time Base + LSD)	Implicitly verified during Time Base Calibration
RF Power Meter	Range: 10 MHz to 1.05 GHz; 10 MHz to 2.7 GHz (OPT 058), 100 mW to 125 W; Resolution: 4 dgts for W or 0.1 dB Accuracy: Broad Band: ±(10% of ind + 1 LSD)	Measured on TI with known signal applied
Demodulation Meters		
FM Deviation Meter	Range: 0 to 150 kHz; Resolution: 10 Hz Accuracy: (1 to 150 kHz FM Dev, IF BW set appropriately for received modulation) ±(3% of ind + source residual FM + 1 LSD)	Measured on TI with known signal applied
AM Meter	Range: 0 to 100%; Resolution: 0.1% Accuracy: (30 to 90% depth, IF BW set appropriately for received modulation) ±(3% of ind + source residual AM + 1 LSD)	
Frequency Demod Counter	Range: 20 Hz to 20 kHz (1 to 100 kHz FM Dev, IF BW set appropriately for received modulation); 20 Hz to 10 kHz (30 to 90% AM, IF BW set appropriately for received modulation) Resolution: 0.1 Hz Accuracy: ±50 ppm	Inherently verified during Audio Function Generator Calibration

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Spectrum Analyzer		
Frequency	Range: 10 MHz to 1.05 GHz; 10 MHz to 2.7 GHz (OPT 058); Resolution: 1 Hz Accuracy: ±(Time Base + LSD)	Implicitly verified during Time Base Calibration
Span	Range: 2 kHz to Full Span (1-2-5 sequence), plus Zero Span, Resolution: 1 Hz Accuracy: Span: ±1% of Span width; Display: ±(Span Accuracy + Frequency Accuracy + 50% of RBW); Marker: ±1% of Span width	
Level	Range: ANT: -90 to +10 dBm; T/R: -50 to +50 dBm Accuracy: (input signal -10 dB from ref level, normalized, preamp off) ±1 dB	Measured on TI with known signal applied
Log Linearity	Range: ANT: -90 to +10 dBm; *[4] T/R: -50 to +50 dBm Accuracy: ±1 dB	Measured on TI with known signal applied
Resolution Bandwidth Accuracy	Range: 300 Hz, 3, 30, 60, 300 kHz and 6 MHz Accuracy: *[5] ±20% of setting, 300 Hz; ±10% of setting, 3, 30, 60, 300 kHz; -10 to +25% of setting, 6 MHz	Not Calibrated
Resolution Bandwidth Selectivity	Range: 300 Hz, 3, 30, 60, 300 kHz and 6 MHz Accuracy: 60 to 3 dB ratio: >10:1 *[5]	
Selectivity Filter Shape	Range: 300 Hz, 3, 30, 60, 300 kHz and 6 MHz Accuracy: >10:1 *[5]	

See footnotes at end of Table.

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Spectrum Analyzer *(Cont.)*		
Bandwidth Switching Error	Range: 10 MHz to 1.05 GHz; 10 MHz to 2.7 GHz (OPT 058) Accuracy: ±1 dB *[5]	Not Calibrated
Harmonic Spurious	Range: 10 MHz to 1.05 GHz; 10 MHz to 2.7 GHz (OPT 058) Accuracy: (input level -30 dBm, ref level -20 dBm) ≤-55 dBc	Signal applied through filters. Harmonic and Non-Harmonic Distortion is then measured
Non-Harmonic Spurious	Range: 10 MHz to 1.05 GHz; 10 MHz to 2.7 GHz (OPT 058) Accuracy: (input level -30 dBm, ref level -20 dBm) ≤-60 dBc	
Third Order Intermodulation (TOI)	Range: 10 MHz to 1.05 GHz; 10 MHz to 2.7 GHz (OPT 058) Accuracy: (input level -30 dBm, ref level -20 dBm) ≤-60 dBc	Two signals at specific offsets are applied to TI. TOI is then measured
Oscilloscope		
Vertical	Range: 2 mV to 20 V/div (1-2-5 sequence) Accuracy: ±5% FS, DC to 1 MHz; ±10% FS, 1 to 4 MHz	Measured on TI with known signal applied
Bandwidth	Range: 2 mV to 20 V/Div, DC to 16 MHz Accuracy: Down not more than 3 dB	Apply a constant amplitude signal while changing frequency. Vertical deflection compared against deflection at a referenced frequency
Horizontal Sweep	Range: 1 μs to 1 s/div (1-2-5 sequence) Accuracy: >1.5% FS	Compared to Standard Time Marks

See footnotes at end of Table.

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Audio Function Generator(s)		
Amplitude	Range: 1 mV to 5 V rms, 20 Hz to 40 kHz Accuracy: (Sine Wave, into 10 kΩ) ±1% of setting	Measured on a Digital Multimeter
Spectral Purity	Range: 1 mV to 5 V rms, 20 Hz to 40 kHz Accuracy: (Sine Wave, 1 kHz, 5 V rms *[6], 80 kHz BW, into 10 kΩ) <0.5% THD	Measured with a Microwave Measurement Receiver
Frequency	Range: 20 Hz to 40 kHz Resolution: 0.1 Hz Accuracy: ±50 ppm	Measured on a Universal Counter
Audio and Modulation Measurements		
AF Counter	Range: 20 Hz to 20 kHz Resolution: 0.1 Hz Accuracy: ±50 ppm	Inherently verified during Audio Function Generator Calibration
SINAD Meter	Range: 300 Hz to 5 kHz, 0 to 60 dB; Resolution: 0.01 dB Accuracy: (SINAD >3 dB, ≤40 dB, 5 kHz LP AF Filter) ±(1.0 dB + 1 LSD)	Inherently verified during Audio Function Generator Calibration
Distortion Meter	Range: 300 Hz to 5 kHz, 0 to 100% distortion; Resolution: 0.1% Accuracy: (5 kHz LP AF Filter) <±0.5%, 1 to 10% distortion; <±1.0%, 10 to 20% distortion	

See footnotes at end of Table.

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Digital Multimeter (3920 OPT 053, 3920N OPT 053 and 3920B Only)		
AC Voltmeter	Range: 200 m to 2000 VAC FS Ranges; Resolution: 3½ dgts (2000 counts) Accuracy: 50 Hz to 20 kHz, ≤150 VAC ±(5% FS + 1 LSD)	Measured on TI with known signal applied
DC Voltmeter	Range: 200 m to 2000 VDC FS Ranges; Resolution: 3½ dgts (2000 counts) Accuracy: ±(1% FS + 1 LSD), ≤150 VDC	
DC Ammeter	Range: 200 m to 20 ADC FS Ranges; *7 Resolution: 3½ dgts (2000 counts) Accuracy: ±(5% FS + 1 LSD)	
AC Ammeter	Range: 200 m to 20 AAC FS Ranges, 50 Hz to 10 kHz; *7 Resolution: 3½ dgts (2000 counts) Accuracy: ±(5% FS + 1 LSD)	
Ohmmeter	Range: 0 to 20 MΩ Resolution: 3½ dgts (2000 counts) Accuracy: ±(5% FS + 1 LSD)	

*1 The accuracy is the manufacturers calculated specification after one year. The accuracy specification is found by multiplying the longest term aging rate by the appropriate time interval to obtain one year.

*2 Typical or operational specification. Not calibrated.

*3 TI 3920: Crossover Frequency = 3411.4 MHz - Generator Frequency. TI 3920B: Crossover Frequency = 1400 MHz - Generator Frequency (10 MHz to 1 GHz). OPT 058: Crossover Frequency = 3400 MHz - Generator Frequency (1 to 2.7 GHz).

*4 See step 3.13.

*5 See step 3.14.

*6 See step 3.15.

*7 20 A (AC and DC) range uses external shunt.

2 EQUIPMENT REQUIREMENTS:

	Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.1	FREQUENCY STANDARD	Range: 10 MHz Accuracy: ±2.5 X 10^{-8}	Arbiter 1083B	
2.2	UNIVERSAL COUNTER	Range: 19.8 Hz to 10.000001 MHz Accuracy: ±0.00125% of rdg	Hewlett-Packard 53132A OPT012-030	
2.3	MICROWAVE MEASUREMENT RECEIVER (MMR)	Range: -131.5 to 0 dBm, 10 MHz to 2.7 GHz Accuracy: Relative Tuned RF Level: Residual Noise to Max power, ±(0.015 dB + 0.005 dB/10 dB); Minimum Power to Residual Noise Threshold, ±(Cumulative Error + 0.0012 X (Input Power - Residual Noise Threshold Power)^2); Range 2, ±0.031 dB; Range 3, ±0.031 dB Range: (Frequency Modulation) 10 MHz to 2.7 GHz, 4 to 103 kHz Deviation, 1 to 15 kHz rate Accuracy: FM Deviation: ±1% of rdg; Distortion: <0.25% THD TAR: 3:1 Range: (Amplitude Modulation) 10 MHz to 2.7 GHz, 24 to 93% AM, 1 kHz rate Accuracy: AM: ±0.5% of rdg; Distortion: <0.25% THD TAR: 2.2:1 Range: (Residual AM) Accuracy: (300 Hz to 3 kHz, rms) <0.025% AM	Agilent N5530SE50	

Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.3 MICROWAVE MEASUREMENT RECEIVER (MMR) *(Cont.)*	Range: -131.5 to 0 dBm, 10 MHz to 2.7 GHz Range: (Phase Noise) Accuracy: <-116 dBc/Hz, <500 MHz; <-112 dBc/Hz, <1 GHz; <-101 dBc/Hz, >1 to 2.7 GHz; (Residual FM): ±2 dB TAR: (Residual FM) 3.9:1 Range: (Audio Distortion) Accuracy: (20 Hz to 250 kHz, -80 to 0 dB), ±1 dB of rdg; Distortion: < 0.3% THD TAR: 1.7:1	Agilent N5530SE50	
2.3.1 SPECTRUM ANALYZER	Range: -110 to +11 dBm, 10 MHz to 13.5 GHz Accuracy: Frequency: ±1 count of LSD; Scale Fidelity: ±1.6 dB	Agilent E4448A	
2.4 ATTENUATOR	Range: 6 dB, 10 MHz to 2.7 GHz Accuracy: N/A	Hewlett-Packard 8491B OPT 006	
2.5 DIGITAL MULTIMETER	Range: 0 to 5.1 V rms, 1 kHz Accuracy: ±0.25% of rdg	Hewlett-Packard 3458A	
2.6 RF SIGNAL GENERATOR	Range: (CW) +0 dBm, 400 MHz Accuracy: N/A	Agilent E8257D OPT 550	
2.7 POWER SPLITTER	Range: 50 MHz to 2.7 GHz Accuracy: ≤0.15 dB	Hewlett-Packard 11667A	
2.8 RF REFERENCE SOURCE	Range: -54 to +16 dBm, 50 MHz, 1 GHz Accuracy: Attenuation: ±0.25 dB from -70 to 0 dB	Fluke 9640A/AF	

	Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.9	SIGNAL GENERATOR	Range: -30 dBm, 40 MHz to 2.7 GHz Accuracy: SSB Phase Noise: <-90 dBc/Hz at 10 kHz offset; Harmonics: ≤-25 dBc	Hewlett-Packard 8664A OPT H15 (P/O E5504B)	
2.10	SYNTHESIZED SWEEPER	Range: 75 MHz to 26.5 GHz, -25 to 0 dBm Accuracy: ±1 count of LSD	Hewlett-Packard 8340B	
2.11	ATTENUATOR (2 EA)	Range: 20 dB Accuracy: N/A	Hewlett-Packard 8491B OPT 020	
2.12	MULTI PRODUCT CALIBRATOR	Range: (DC Voltage) 0 to 1000 VDC Accuracy: ±0.28% of setting Range: (AC Voltage) 0 to 1000 VAC, 50 Hz to 20 kHz Accuracy: ±1.4% of setting Range: (DC Current) 0 to 18 ADC Accuracy: ±1.4% of setting Range: (AC Current) 0 to 1.8 AAC, 60 Hz to 10 kHz 0 to 18 AAC, 60 Hz to 5 kHz Accuracy: ±1.4% of setting Range: (Resistance) 180 Ω to 18 MΩ Accuracy: ±1.4% of setting	Fluke 5520A/AF	

Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.13 OSCILLOSCOPE CALIBRATOR	Range: -7 to +7 VDC Accuracy: ±0.39% of setting Range: 1 kHz, 12 mV to 100 V p-p Accuracy: ±1.6% of setting Range: 50 kHz to 16.1 MHz, 12 mV to 3 V p-p Accuracy: ±5% of ref at 50 kHz Range: Time Mark: 1 µs to 1 s Accuracy: ±12.5 ppm	Fluke 9500B/3200AF	
2.14 FEEDTHROUGH TERMINATION	Range: 50 Ω Accuracy: N/A	Tektronix 011-0049-01	
2.15 POWER AMPLIFIER	Range: 8 to 55 W, 10 to 400 MHz Accuracy: N/A	Microwave Products SSPA0240-22/6140	PST Corp. BHED1758-200/4006
2.16 COUPLER SET	Range: 400 MHz Accuracy: ±3% of charted value *1	Premier Microwave 1852A	Bird 4421A300
2.17 POWER METER	Range: 1 to 10 mW Accuracy: ±1% of rdg *1	Hewlett-Packard 432B-H05	Bird 4421A300
2.18 RESISTOR	Range: 10 kΩ Accuracy: ±0.1% of nominal	As Available	
2.19 LOCKOUT KEY	Range: N/A Accuracy: N/A	IFR 7005-7840-500	
2.20 ATTENUATOR *2	Range: 10 to 400 MHz Accuracy: N/A	Weinschel 82-10-34	

See footnotes at end of Equipment Requirements.

Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.21 POWER METER	Range: -31 to +11 dBm Accuracy: *[3]	Hewlett-Packard E4418B	
2.22 POWER SENSOR	Range: 10.1 to 2700 MHz Accuracy: (all % are of charted value) ±6.4%, 10.1 MHz to ≤2.7 GHz	Hewlett-Packard E4412A	

*[1] A worst case TAR of 3.2:1 is achieved by the root sum squared (RSS) value of the Coupler Set and the Power Meter (2.17) for the RF Power Meter Calibration.

*[2] Only required if using the Sub-Items for Power Amplifier, Coupler Set and Power Meter (2.17).

*[3] Power Meter (2.21) Accuracy included in Power Sensor Accuracy.

3 PRELIMINARY OPERATIONS:

3.1 Review and become familiar with the entire procedure before beginning the Calibration Process.

WARNING

Unless otherwise designated, and prior to beginning the Calibration Process, ensure that all test equipment voltage and/or current outputs are set to zero (0) or turned off, where applicable. Ensure that all equipment switches are set to the proper position before making connections or applying power. If not strictly observed, could result in injury to, or death of, personnel or long term health hazards.

3.2 Connect the test equipment to the appropriate power source. Set all POWER switches to ON and allow warm-up as required by the manufacturer.

3.3 Connect the TI Power Cord to the appropriate power source. Set TI rear panel I/O switch to I.

3.4 Press the TI front panel POWER On/Standby key. Allow a 45 min warm-up period.

3.5 Throughout the Calibration Procedure, when directed to a submenu or menu value, use the ↑, ↓, ← and →, as necessary, to select the submenu or menu value then press SELECT. When required to enter a value, utilize the DATA ENTRY numerical keys, as necessary, to enter the value.

3.6 Throughout the Calibration Procedure, all TI hardkeys will be in all CAPS, softkeys will be underlined, submenus will be in **Bold**, and menu values will be in *Italics*.

3.7 Throughout the Calibration Procedure, the SELECT button may need to be used to enter on screen prompts. When selecting TI Tiles use the TAB and SELECT buttons, as required, to select and expand the function under test.

3.8 Press the TI UTILS twice, then select Software Settings and License to view options. Press TI UTILS, Store/Recall, Restore Factory Defaults, then select All Systems, System and Analog Duplex.

3.9 Multiple firmware versions may exist for TIs covered by this Calibration Procedure. This may require variations of softkeys, menus, keystrokes, pathways, steps or etc. to achieve setting of the TI to the required state/configuration. These variations are permitted provided the required state/configuration is maintained. Technicians may need to consult the commercial data and become familiar with the softkeys, menus, keystrokes, pathways, steps or etc. to activate the exact TI state/configuration required by each respective step in the Calibration Procedure prior to performing the Calibration Process. These variations do not constitute changes required to the Calibration Procedure.

3.10 When entering keystrokes and changing functions with the MMR, allow sufficient time for the unit to register the entries.

NOTE

Whenever a measurement is made with MMR at a carrier frequency of <20 MHz, the RF coupling must be set to DC. The 50 GHz MMR RF coupling is always DC. The 26.5 GHz MMR RF coupling must be set to DC.

3.11 Set the MMR for the Factory Preset. Preset the MMR. Perform Align All Now.

NOTE

The 50 Ω Leveling Head (p/o RF Reference Source) is an integral part of the RF Reference Source. All connections are to be made through the 50 Ω Leveling Head.

3.12 Make a copy of Tables for use as Calibration Worksheets as required.

3.13 Annotate and attach a Limited Certification Label stating: Log Linearity ANT not calibrated below -60 dBm due to noise floor interference.

3.14 Annotate and attach a Limited Certification Label stating: Resolution Bandwidth Accuracy, Resolution Bandwidth Selectivity, Selectivity Filter Shape, and Bandwidth Switching Error not calibrated.

3.15 Due to lack of standards, annotate and attach a Limited Certification Label stating: Audio Function Generator Spectral Purity calibrated from 100 mV to 3 V rms.

3.16 If the Current Shunt (P/O TI Accessory Kit) does not accompany the TI during calibration, annotate and attach a Limited Certification Label stating the TI Digital Multimeter Current Meter 20A Range is not certified. If the Current Shunt is available, annotate the S/N or the ID# of the TI which it was calibrated with in accordance with T.O. 00-20-14 requirements.

3.17 USER CALIBRATION PROCEDURE:

NOTE

Throughout the Calibration Process, perform the User Calibration Procedure when the CAL indicator appears at the bottom of the TI display tile.

3.17.1 Ensure all connectors, adapters, and dust caps are removed from TI front panel connectors.

3.17.2 Press the TI UTILS twice, **User Calibration**, then SELECT.

3.17.3 Set TI **User Calibration Threshold** to *1.0* dBm.

NOTE

There may be delays between the start of the user calibration and a TI display update. After pressing Continue, wait for TI to display user calibration status progress bar before proceeding.

3.17.4 Press TI Run User Calibration, then Continue.

3.17.5 Verify no errors are displayed on TI. Press TI RETURN.

3.18 For TI 3920N, serial numbers 1001681624 and up use the 3920B hardware configuration, and should be tested to the 3920B specification. All units prior to that, or having undergone repairs that would require the Generator module to be updated, should be tested to the 3920 specification.

4 CALIBRATION PROCESS:

NOTE

Unless otherwise specified, verify the results of each test and take corrective action whenever the test requirement is not met, before proceeding.

4.1 TIME BASE AND SIGNAL GENERATOR FREQUENCY CALIBRATION:

NOTE

Adjustment of the Time Base Oscillator is normal due to the Aging Rate of the crystals. This is common to all Quartz Oscillators. The adjustment actions taken during this calibration will ensure the greatest reliability of the TI by adjusting the time base reference to the nominal value each time it is calibrated.

4.1.1 Connect Frequency Standard 10 MHz Output to the Universal Counter Ref In.

4.1.2 Connect TI EXT REF IO (rear panel) to the Universal Counter CHANNEL 1 Input. Set the Universal Counter 50Ω/1MΩ switch to 50Ω.

4.1.3 Adjust Universal Counter controls as required for a stable display indication.

NOTE

The values in the following steps are derived from multiplication of the Aging Rate to determine the offset at one year. Use these calculated one year values regardless of the length of the calibration interval for this TI in T.O. 33K-1-100-1/2. The longest aging rate specification not to exceed 1 year has been used to calculate the limits.

4.1.4 Verify the Universal Counter indication is within 9 999 999 to 10 000 001 Hz.

4.1.5 Disconnect test setup.

4.1.6 To ensure the reliability of the TI, the following action shall be taken: If TI passes the above steps, perform the applicable adjustment steps in Appendix A and enter the applicable code into the Maintenance Data Collection System. If the TI failed, perform the applicable steps listed in Appendix A and enter the applicable code into the Maintenance Data Collection System.

4.2 SIGNAL GENERATOR OUTPUT LEVEL CALIBRATION:

4.2.1 Repeat step 3.8. Select TI Generators window.

4.2.2 Standardize Power Meter (2.21) and Power Sensor. Set the Power Meter (2.21) measurement in the dBm mode.

NOTE

Ensure the Power Sensor Calibration Factors have been programmed into the Power Meter (2.21) memory. Select the appropriate Power Sensor file throughout the Calibration Process.

4.2.3 Connect TI T/R Output to the Power Sensor.

4.2.4 Set TI **RF OUT** to *T/R* and set **Level** to *-30* dBm.

4.2.5 Set the TI **RF Freq** to the first value listed in the Applied Frequency column of Table 2 and set **RF GEN** to *ON*. Set the MMR Ext RF Atten to 0.0 dB.

4.2.6 Verify the Power Meter (2.21) indication is within the corresponding values listed in the Limits column of Table 2. Record the Power Meter (2.21) indication.

4.2.7 Set the TI **RF Freq** to the next value listed in the Applied Frequency column of Table 2.

4.2.8 Repeat step 4.2.6.

4.2.9 Repeat step 4.2.7 and 4.2.8 for the remaining corresponding values listed in Table 2.

Table 2.

Applied Frequency (MHz)	T/R Level (dBm)	Limits (dBm)
10.1	-30	-31 to -29
100	-30	-31 to -29
500	-30	-31 to -29
750	-30	-31 to -29
1000	-30	-31 to -29
2700 *	-30	-31 to -29

* For TI with OPT 058 only.

4.2.10 Set TI **RF GEN** to *OFF*.

4.2.11 Disconnect the Power Sensor from the test setup.

4.2.12 Connect the MMR 10 MHz OUT (SWITCHED) to the TI EXT REF I/O (rear panel).

4.2.13 Set the MMR controls, as required, to provide a 10 MHz timebase output.

4.2.14 Press TI UTILS twice, *Hardware Settings*, *frequency reference*, **SELECT** then *external*. Press RETURN.

4.2.15 Connect the TI T/R Output to the MMR RF INPUT 50 Ω.

4.2.16 Set the TI **RF Freq** to *10.1* MHz and set **RF GEN** to *ON*.

4.2.17 Set the MMR frequency to the TI frequency.

NOTE

For Tuned RF Level measurements do not change the signal level during the Range 2 Switch Level Cal Factor and Range 3 Switch Level Cal Factor calibration. Wait for the red calibrating message to disappear before continuing. Use this method throughout the Calibration Process when making Tuned RF Level measurements.

4.2.18 Set TI **Level** to the first value listed in the Level column of Table 3.

4.2.19 Set the MMR to make a Tuned RF Level measurement in High Accuracy mode.

4.2.20 Set the MMR to Set Ref.

4.2.21 Allow the MMR Tuned RF Level indication to settle.

4.2.22 Set the MMR Ext RF Atten to the value recorded, in dB, in step 4.2.6 for the frequency being verified.

4.2.23 Press TI **Level**, then set to the next value listed in the Level column of Table 3.

4.2.24 Allow the MMR Tuned RF Level indication to settle. Verify the MMR Tuned RF Level indication is within the corresponding values listed in the Limits column of Table 3.

4.2.25 Repeat steps 4.2.23 and 4.2.24 for the remaining values listed in the Level column of Table 3 for the frequency being verified.

Table 3.

Level (dBm)	Limits (dB)
-30	Reference
-40	-41 to -39
-50	-51 to -49
-60	-61 to -59

Table 3. (Cont.)

Level (dBm)	Limits (dB)
-70	-71 to -69
-80	-81 to -79
-90	-91 to -89
-100	-101 to -99
-109	-110 to -108
-111 *	-112.5 to -109.5
-120 *	-121.5 to -118.5
-130 *	-131.5 to -128.5

* For TI 3920B only.

4.2.26 Set TI **RF GEN** to *OFF*.

4.2.27 Set the MMR Ext RF Atten to 0.0 dB.

4.2.28 Repeat steps 4.2.16 through 4.2.27 for test frequencies of 100, 500, 750 MHz and 1 GHz (and 2.7 GHz for TI with OPT 058 only).

4.2.29 Disconnect the MMR RF INPUT 50 Ω from the TI T/R Output.

4.2.30 Connect TI GEN Output to the Power Sensor. Set the TI **RF OUT** to *GEN*.

4.2.31 Set the TI **RF Freq** to the first value listed in the Frequency column of Table 4 and set **RF GEN** to *ON*.

4.2.32 Set TI **Level** to the first value listed in the Level column of Table 4 for the frequency being verified.

4.2.33 Verify the Power Meter (2.21) indication is within the corresponding values listed in the Limits column of Table 4. Record the Power Meter (2.21) indication at 0 dBm.

4.2.34 Set TI **Level** to the next value listed in the Level column of Table 4.

4.2.35 Verify the Power Meter (2.21) indication is within the corresponding values listed in the Limits column of Table 4.

4.2.36 Set the TI **RF Freq** to the next value listed in the Frequency column of Table 4.

4.2.37 Repeat steps 4.2.32 through 4.2.35.

4.2.38 Repeat steps 4.2.36 and 4.2.37 for the remaining corresponding values listed in Table 4.

Table 4.

Frequency (MHz)	Level (dBm)	Limits (dBm)
10.1	0	-1 to +1 *
	+10	+9 to +11
100	0	-1 to +1 *
	+10	+9 to +11
500	0	-1 to +1 *
	+10	+9 to +11
750	0	-1 to +1 *
	+10	+9 to +11
1000	0	-1 to +1 *
	+10	+9 to +11
2700 **	0	-1 to +1 *
	+10	+9 to +11

* Record indication.

** For TI with OPT 058 only.

4.2.39 Set TI **RF GEN** to *OFF*.

4.2.40 Disconnect the Power Sensor from the test setup.

4.2.41 Connect the TI GEN Output to the MMR RF INPUT 50 Ω.

4.2.42 Set the TI **RF Freq** to *10.1* MHz and set **RF GEN** to *ON*.

4.2.43 Set the MMR frequency to the TI frequency.

NOTE

For Tuned RF Level measurements do not change the signal level during the Range 2 Switch Level Cal Factor and Range 3 Switch Level Cal Factor calibration. Wait for the red calibrating message to disappear before continuing. Use this method throughout the Calibration Process when making Tuned RF Level measurements.

4.2.44 Press TI **Level** and set to the first value listed in the Level column of Table 5.

4.2.45 Set the MMR to make a Tuned RF Level measurement in High Accuracy mode.

4.2.46 Set the MMR to Set Ref.

4.2.47 Allow the MMR Tuned RF Level indication to settle.

4.2.48 Set the MMR Ext RF Atten to the value recorded, in dB, in step 4.2.33 for the frequency being verified.

4.2.49 Press TI **Level**, then set to the next value listed in the Level column of Table 5.

4.2.50 Allow the MMR Tuned RF Level indication to settle. Verify the MMR Tuned RF Level indication is within the corresponding values listed in the Limits column of Table 5.

4.2.51 Repeat steps 4.2.49 and 4.2.50 for the remaining values listed in the Level column of Table 5 for the frequency being verified.

Table 5.

Level (dBm)	Limits (dB)
0	Reference
-10	-11 to -9
-20	-21 to -19
-30	-31 to -29
-40	-41 to -39
-50	-51 to -49
-60	-61 to -59
-70	-71 to -69
-80	-81 to -79
-90	-91 to -89
-100	-101 to -99
-109	-110 to -108
-111 *	-112.5 to -109.5
-120 *	-121.5 to -118.5
-130 *	-131.5 to -128.5

* For TI 3920B only.

4.2.52 Set the TI **RF GEN** to *OFF*.

4.2.53 Repeat steps 4.2.42 through 4.2.52 for test frequencies of 100, 500, 750 MHz and 1 GHz (and 2.7 GHz for TI with OPT 058 only).

4.2.54 Disconnect the test setup.

4.2.55 Set the MMR controls, as required, to turn off the 10 MHz timebase output.

4.3 SIGNAL GENERATOR SPECTRAL PURITY CALIBRATION:

4.3.1 Repeat step 3.8. Select TI Generators window.

4.3.2 Connect the TI GEN connector through the Attenuator (2.4) to the MMR RF INPUT 50 Ω.

4.3.3 Set the MMR to Spectrum Analysis mode. Set MMR input Attenuation to 30 dB.

4.3.4 Press the TI RF Out key, set to *GEN* and **RF Freq** to the first value listed in the Freq column of Table 6. Set **Level** to *10* dBm and set **RF GEN** to *ON*.

4.3.5 Set the MMR for Harmonic Distortion measurements at the TI frequency.

4.3.6 Verify the MMR Amplitude indication of the first four Harmonic signals is within the value listed in the Limits column of Table 6.

4.3.7 Set the MMR measurement to Off.

4.3.8 Set TI **RF Freq** to the next value listed in the Freq column of Table 6.

4.3.9 Repeat steps 4.3.5 through 4.3.7.

4.3.10 Repeat steps 4.3.8 and 4.3.9 for the remaining corresponding values listed in Table 6.

Table 6.

Freq (MHz)	Limits (dBc)
10.1	<-25
100	<-25
500	<-25
750	<-25
1000	<-25
2700 *	<-25

* For TI with OPT 058 only.

4.3.11 Set TI **RF Freq** to the first value listed in the Freq column of Table 7.

4.3.12 Set MMR to the same frequency as the TI.

4.3.13 Set the MMR controls to place the peak of the carrier at a convenient reference level.

4.3.14 Set the MMR controls as required to measure any Spurious Signal level.

4.3.15 Verify the amplitude of any Spurious Signal (except at the applicable Crossover Frequency) is within the value listed in the corresponding Non-Harmonic Limits column of Table 7.

4.3.16 Verify the amplitude of the Spurious Signal at the applicable Crossover Frequency is within the value listed in the corresponding Crossover Limits column of Table 7.

4.3.17 Set TI **RF Freq** to the next value listed in the Freq column of Table 7.

4.3.18 Repeat step 4.3.12 through 4.3.16.

4.3.19 Repeat steps 4.3.17 and 4.3.18 for the remaining corresponding values listed in Table 7.

Table 7.

		Limits (dBc)	
Freq (MHz)	**Crossover Freq (GHz)**	**Non-Harmonics**	**Crossover**
10.1	3.4013 *1	<-55	<-35
	1.3899 *2	<-55	<-35
100	3.3114 *1	<-55	<-35
	1.300 *2	<-55	<-35
500	2.9114 *1	<-55	<-35
	0.900 *2	<-55	<-35
750	2.6614 *1	<-55	<-35
	0.650 *2	<-55	<-35
999 *2	0.401	<-55	<-35
1000 *1	2.4114	<-55	<-35
2700 *3	0.7114	<-55	<-35
2700 *4	0.700	<-55	<-35

*1 For TI 3920 only.

*2 For TI 3920B only.

*3 For TI 3920 with OPT 058 only.

*4 For TI 3920B with OPT 058 only.

4.3.20 Set the TI **RF GEN** to *OFF* and leave equipment connected.

4.4 SIGNAL GENERATOR RESIDUAL FM AND PHASE NOISE CALIBRATION:

4.4.1 Repeat step 3.8. Select TI Generators window.

4.4.2 Press the TI RF Out key, set **RF OUT** to *GEN* and **RF Freq** to *10.1* MHz. Set **Level** to *+10* dBm and set **RF GEN** to *ON*.

4.4.3 Ensure the MMR Spectrum Analyzer is set to Spectrum Analysis Mode. Set the Center Frequency to the TI frequency, Span to 50 kHz and RBW to 300 Hz. Set the reference level as required to set the peak at a convenient level.

NOTE

The MMR Spectrum Analyzer will display the indication in dB/Hz vs dBc/Hz.

4.4.4 Set the MMR Spectrum Analyzer to do a peak search, set the Marker Delta to 20 kHz (10 kHz for TI 3920B) and set the Marker Noise to on.

4.4.5 Verify the MMR Spectrum Analyzer ΔMkr Noise Level is within the corresponding value listed in the applicable Limits column in Table 8.

4.4.6 Set the MMR Spectrum Analyzer Markers to Off.

4.4.7 Set the TI **RF Freq** to the next value listed in the Applied column of Table 8.

4.4.8 Repeat steps 4.4.3 through 4.4.7 for the remaining values in Table 8.

Table 8.

Applied (MHz)	Limits (dBc/Hz) 3920 and 3920N	3920B
10.1	<-93	<-110
100	<-93	<-110
500	<-93	<-106
750	<-93	<-106
1000 *[1]	<-93	N/A
1050 *[2]	N/A	<-95
2700 *[3]	<-90	<-95

*[1] For TI 3920 and 3920N only.

*[2] For TI 3920B only.

*[3] For TI with OPT 058 only.

4.4.9 Set the TI FREQ to the first value listed in the Applied column of Table 9.

4.4.10 Set the MMR to Measuring Receiver mode.

4.4.11 Set the MMR Frequency to the TI frequency.

4.4.12 Set the MMR controls, as required, to measure FM Deviation. Set the High Pass Filter to 300 Hz, Low Pass Filter to 3 kHz and Detector to RMS.

4.4.13 Verify the MMR FM Deviation indication is within the corresponding value listed in the applicable Limits column of Table 9.

4.4.14 Set the TI FREQ to the next value listed in the Frequency column of Table 9.

4.4.15 Set the MMR Frequency to the TI frequency. Restart the MMR.

4.4.16 Repeat steps 4.4.12 through 4.4.15, as required, for the remaining values listed in Table 9.

Table 9.

	Limits (Hz rms)	
Applied (MHz)	**3920 and 3920N**	**3920B**
10.1	<15	<5
100	<15	<5
500	<15	<5
750	<15	<5
1000	<15	<5
2700 *	<15	<5

* For TI with OPT 058 only.

4.4.17 Disconnect test setup.

4.5 SIGNAL GENERATOR RESIDUAL AM CALIBRATION:

4.5.1 Repeat step 3.8. Select TI Generators window.

4.5.2 Connect the TI GEN connector through the Attenuator (2.4) to the MMR RF INPUT 50 Ω.

4.5.3 Set the MMR to Measuring Receiver mode.

4.5.4 Press the TI RF Out key, set **RF OUT** to *GEN* and **RF Freq** to *1.0* GHz (*2.7* GHz for OPT 058). Set **Level** to *0* dBm and set **RF GEN** to *ON*.

4.5.5 Set the MMR Frequency to the TI carrier frequency.

4.5.6 Set the MMR controls, as required, to measure AM Depth. Set High Pass Filter to 300 Hz and Low Pass Filter to 3 kHz and set the Detector to RMS.

4.5.7 Allow the MMR AM Depth indication to settle. Verify the MMR AM Depth indication is <0.1% rms.

4.5.8 Set the TI **RF GEN** to *OFF* and leave test setup connected.

4.6 SIGNAL GENERATOR FREQUENCY MODULATION CALIBRATION:

4.6.1 Repeat step 3.8. Select TI Generators window.

4.6.2 Set the MMR to Measuring Receiver mode.

4.6.3 Press the TI RF Out key, set **RF OUT** to *GEN* and **RF Freq** to the first value listed in the Applied Frequency column of Table 10. Set **Level** to *-10* dBm and set **RF GEN** to *ON*.

4.6.4 Set TI to *FM,* select **Mod1**, set the first TI value to the first value listed in the Applied Rate column of Table 10 and the second TI value to the first value listed in the Applied Deviation column of Table 10 then select *Sine*.

NOTE

Ensure TI **Mod1** is highlighted in green. If not, take the necessary steps to do so.

4.6.5 Set the MMR Frequency to the TI carrier frequency.

4.6.6 Set the MMR controls, as required, to measure FM Deviation. Set High Pass Filter to 300 Hz and Low Pass Filter to 15 kHz and the Detector to Peak +.

4.6.7 Verify the MMR FM Deviation indicates within the corresponding values listed in the Limits Deviation column of Table 10.

4.6.8 As required, verify the MMR distortion indication is within the corresponding value listed in the Limits Distortion column of Table 10.

4.6.9 Repeat steps 4.6.4 through 4.6.8, as required, for the remaining corresponding values listed in Table 10 for the frequency being verified.

4.6.10 Set TI **RF Freq** to the next value listed in the Applied Frequency column of Table 10.

4.6.11 Repeat steps 4.6.4 through 4.6.9.

4.6.12 Repeat steps 4.6.10 and 4.6.11 for the remaining corresponding values listed in Table 10.

Table 10.

Frequency (MHz)	Applied Deviation (kHz)	Rate (Hz)	Limits Deviation (kHz)	Limits Distortion (%)
10.1	6	1000	5.82 to 6.18	<1
	100	1000	97.00 to 103.0	N/A
		15000	97.00 to 103.0	N/A
1000	6	1000	5.82 to 6.18	<1
	100	1000	97.00 to 103.0	N/A
		15000	97.00 to 103.0	N/A
2700 *	6	1000	5.82 to 6.18	<1
	100	1000	97.00 to 103.0	N/A
		15000	97.00 to 103.0	N/A

***** For TI with OPT 058 only.

4.6.13 Set the TI **RF GEN** to *OFF* and leave test setup connected.

4.7 SIGNAL GENERATOR AMPLITUDE MODULATION CALIBRATION:

4.7.1 Repeat step 3.8. Select TI Generators window.

4.7.2 Set the MMR to Measuring Receiver mode.

4.7.3 Press the TI RF Out key, set **RF OUT** to *GEN* and **RF Freq** to the first value listed in the Applied Frequency column of Table 11. Set **Level** to *-10* dBm and set **RF GEN** to *ON*.

4.7.4 Set TI **MOD** to *AM,* **MOD 1** to *1* kHz and TI **Mod 1** % to the first value listed in the Applied Depth column of Table 11 for the frequency being verified.

NOTE

Ensure TI **MOD 1** is highlighted in green. If not, repeat the applicable portions of step 4.7.4.

4.7.5 Set the MMR Frequency to the TI carrier frequency.

4.7.6 Set the MMR controls, as required, to measure AM Depth. Set High Pass Filter to 300 Hz and Low Pass Filter to 3 kHz and the Detector to Peak + - / 2.

4.7.7 Allow the MMR AM Depth indication to settle. Verify the MMR AM Depth indication is within the corresponding values listed in the Limits Depth column of Table 11.

4.7.8 As required, verify the MMR AM Mod Distortion indication is within the corresponding value listed in the Limits Distortion column of Table 11.

4.7.9 Set TI **Mod 1** % to the next value listed in the Applied Depth column of Table 11.

4.7.10 Repeat steps 4.7.6 through 4.7.8.

4.7.11 Repeat steps 4.7.10 and 4.7.11 for the remaining corresponding value listed in Table 11 for the frequency being verified.

4.7.12 Set TI **RF Freq** to the next value listed in the Applied Frequency column of Table 11.

4.7.13 Repeat steps 4.7.4 through 4.7.11.

4.7.14 Repeat steps 4.7.12 and 4.7.13 for the remaining corresponding values listed in Table 11.

Table 11.

Applied		Limits (%)	
Frequency (MHz)	**Depth (%)**	**Depth**	**Distortion**
10.1	30	29 to 31	<1
	50	49 to 51	<1
	90	89 to 91	N/A
1000	30	29 to 31	<1
	50	49 to 51	<1
	90	89 to 91	N/A
2700 *	30	29 to 31	<1
	50	49 to 51	<1
	90	89 to 91	N/A

***** For TI with OPT 058 only.

4.7.15 Set the TI **RF GEN** to *OFF* and disconnect test setup.

4.8 RECEIVER RF POWER METER CALIBRATION:

4.8.1 Repeat step 3.8. Select TI Analyzer windows.

CAUTION

Damage to the TI may occur if >50 W continuous is applied. If not strictly observed, could result in damage to, or destruction of, equipment or loss of mission effectiveness.

CAUTION

The Attenuator (2.20) must be used when using the Sub-Item for the Power Amplifier to avoid damage to the TI. If not strictly observed, could result in damage to, or destruction of, equipment or loss of mission effectiveness.

4.8.2 Connect equipment as shown in Figure 1.

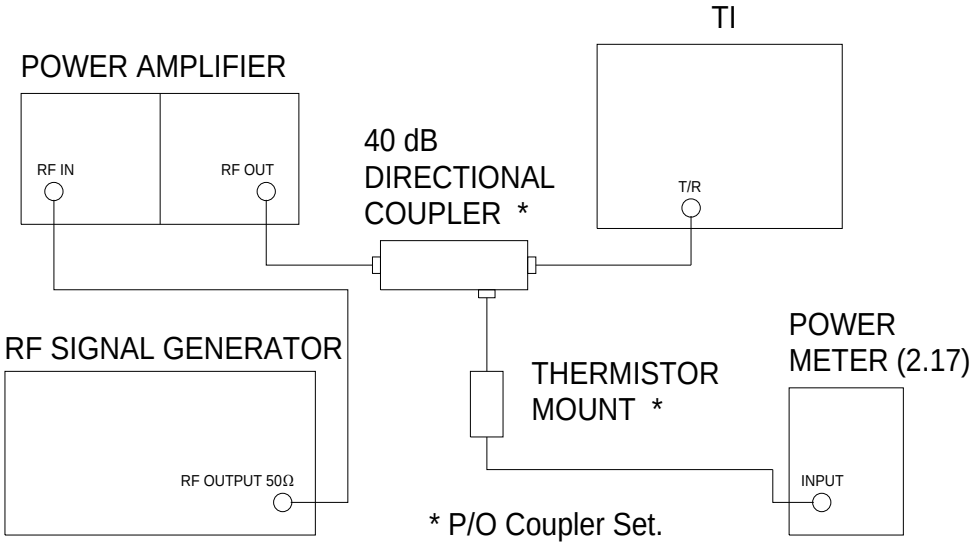

Figure 1.

4.8.3 Set the TI **RF IN** to *T/R* and set **RF freq** to *400* MHz. Set TI **Units** to W. Press TI →, **Inband**, SELECT, **Broad Band**, →, *0*, then SELECT and follow the on-screen prompts.

4.8.4 On the Power Meter (2.17) set switch to 40 dB Coupler and CAL FACTOR/Vernier controls to the appropriate value.

4.8.5 On the Power Amplifier set the Filter Switching Unit BAND SELECT-MHz to 250-400 and POWER ADJUST controls fully CCW.

4.8.6 Set the RF Signal Generator as required for 0.0 dBm output at 400 MHz.

4.8.7 On the Power Amplifier set the Filter Switching Unit 250-400 MHz POWER ADJUST controls to the first value listed in the Applied column of Table 12 as indicated on the Power Meter (2.17).

4.8.8 Verify the TI **POWER** indication is within the values listed in the Limits column of Table 12.

4.8.9 On the Power Amplifier set the Filter Switching Unit 250-400 MHz POWER ADJUST controls for minimum.

4.8.10 Repeat steps 4.8.7 through 4.8.9 for the remaining values listed in Table 12.

Table 12.

Applied (W)	Limits (W)
10	8.99 to 11.01
30	26.99 to 33.01
50	44.9 to 55.1

4.8.11 Set outputs to minimum and disconnect test setup.

4.9 RECEIVER FM DEVIATION METER CALIBRATION:

4.9.1 Connect the Signal Generator RF OUTPUT to the input of the Power Splitter. Connect one output port of the Power Splitter to the MMR RF INPUT 50 Ω and the other output port to the TI T/R connector.

4.9.2 Set the Signal Generator to output a 12.5 MHz carrier wave, 0.0 dBm, internally FM modulated signal at a 1 kHz rate with 4.5 kHz of FM deviation.

4.9.3 Set the MMR controls, as required, to measure FM Deviation. Set High Pass Filter to 300 Hz and Low Pass Filter to 3 kHz. Press Detector, then Peak +. Adjust the Signal Generator for a MMR FM Deviation indication of 4.5 kHz.

4.9.4 Repeat step 3.8. Select the TI Analyzer window. Set **RF IN** to *T/R*, **DEMOD** to *FM*, **RF Freq** to *12.5* MHz. Set **FILTER** (default states NO FILTER) to 300 Hz to 3.4 kHz BP.

4.9.5 Set the TI **IF BW** to *25* kHz.

4.9.6 Verify the TI **FM** indication is within 4.35 to 4.65 kHz.

4.9.7 Set the TI **RF Freq** to *100.0* MHz.

4.9.8 Repeat step 4.9.2 for a 100 MHz carrier wave.

4.9.9 Set the TI **IF BW**, to the next value listed in the IF BW column of Table 13.

4.9.10 Adjust the Signal General FM Deviation, as required, for a MMR FM Deviation indication of the first value listed in the Applied column of Table 13.

4.9.11 Verify the TI **FM** indication is within the values listed in the appropriate Limits column of Table 13.

4.9.12 Repeat steps 4.9.9 through 4.9.11 for the remaining corresponding values listed in Table 13.

Table 13.

IF BW (kHz)	Applied (kHz)	Limits (kHz)
25	9.0	8.72 to 9.28
100	18.0	17.45 to 18.55
300	35	33.94 to 36.06

4.9.13 Set all outputs to minimum and disconnect test setup.

4.10 RECEIVER AM METER CALIBRATION:

4.10.1 Repeat step 3.8.

4.10.2 Connect the Signal Generator RF OUTPUT to the input of the Power Splitter. Connect one output port of the Power Splitter to the MMR RF INPUT 50 Ω and the other output port to the TI T/R connector.

4.10.3 Set the Signal Generator to output a 12.5 MHz carrier wave, 0.0 dBm, internally AM modulated signal at a 1 kHz rate with 30% AM depth.

4.10.4 Set the MMR controls, as required, to measure AM Depth. Set High Pass Filter to 300 Hz and Low Pass Filter to 3 kHz. Press Detector, then Peak +-/2.

4.10.5 Press MMR **MEASURE**, then *AM Depth*.

4.10.6 Select the TI Analyzers window. Set **RF IN** to *T/R*, **DEMOD** to *AM*, **RF Freq** to *12.5* MHz. Set **FILTER** (default states NO FILTER) to 300 Hz to 3 kHz BP.

4.10.7 Adjust the Signal Generator AM Depth, as required, for a MMR AM Depth indication of the first value listed in the Applied column of Table 14.

4.10.8 Verify the TI AM modulation indication is within the corresponding values listed in the Limits column of Table 14.

4.10.9 Repeat steps 4.10.7 and 4.10.8 for the remaining corresponding values listed in Table 14.

Table 14.

Applied (%)	Limits (%)
25	24.2 to 25.9
30	29.0 to 31.0
45	43.6 to 46.5
50	48.4 to 51.6
75	72.7 to 77.4
90	87.2 to 92.8

4.10.10 Set all outputs to minimum and disconnect test setup.

4.11 SPECTRUM ANALYZER LEVEL CALIBRATION:

4.11.1 Repeat step 3.8. Select the TI Analyzers window and set **RF Freq** to *1.0* GHz. Press TI TEST key and select TI **Spectrum Analyzer** from floating window.

4.11.2 Connect RF Reference Source Ref Frequency Output to the TI EXT REF I/O (rear panel). Connect RF Reference Source Output to the TI ANT connector.

4.11.3 Set RF Reference Source, as required, for a 10 MHz reference output.

4.11.4 Press TI UTILS twice, *Hardware Settings, frequency reference*, **SELECT** then external. Press RETURN.

4.11.5 Set the TI **SPAN** to *100* kHz and **Ref Level** to *-20* dBm. Set **RF In** to *ANT*.

4.11.6 Set the RF Reference Source for 1 GHz at -30.0 dBm.

4.11.7 Select TI Markers, Mkr1, Mkr1 and PK.

4.11.8 Verify TI Mkr1 indication is within -31 to -29 dBm.

4.11.9 Set RF Reference Source output to minimum. Disconnect RF Reference Source Output from the TI ANT connector.

4.11.10 Connect RF Reference Source Output to the TI T/R connector.

4.11.11 Repeat steps 4.11.5 through 4.11.8 for the TI T/R input.

4.11.12 Set the RF Reference Source output to minimum. Leave equipment connected.

4.12 SPECTRUM ANALYZER LOG LINEARITY CALIBRATION:

4.12.1 Press TI TEST key and select TI Analog Duplex from floating window. Select the TI Analyzers window and set **RF Freq** to *50.0* MHz. Press TI TEST key and select TI **Spectrum Analyzer** from floating window.

4.12.2 Disconnect RF Reference Source Output from the TI T/R connector. Connect the RF Reference Source Output through the Attenuator (2.4) to the TI ANT.

4.12.3 Set the RF Reference Source Frequency to 50 MHz and Level to +16.0 dBm.

4.12.4 Set TI **SPAN** to *100* kHz and **Ref Level** to *+10* dBm. Set **RF In** to *ANT*. Set the TI **CF** to *50* MHz, as required.

4.12.5 Select TI Markers, Mkr1, Mkr1 and PK. Record TI Mkr1 indication in the corresponding Mkr Reading column in a copy of Table 15.

4.12.6 Set the RF Reference Source output level to the next value listed in the Level column of Table 15.

4.12.7 Set TI Mkr1 to PK. Record TI Mkr1 indication in a copy of the corresponding Mkr Reading column of Table 15.

4.12.8 Algebraically subtract the value recorded in step 4.12.5 from the value recorded in step 4.12.7.

4.12.9 Verify the result of step 4.12.8 is within the values listed in the Limits column of Table 15.

4.12.10 Repeat steps 4.12.5 through 4.12.9 for the remaining corresponding values listed in Table 15.

Table 15.

Level (dBm)	Mkr Reading (dB)	Limits (dB)
+16	_____	Reference
6	_____	-11 to -9
-4	_____	-11 to -9
-14	_____	-11 to -9
-24	_____	-11 to -9
-34	_____	-11 to -9
-44 *	_____	-11 to -9
-54	_____	-11 to -9

* Press TI **Averages**.

4.12.11 Set the RF Reference Source output to minimum and disconnect test setup.

4.13 SPECTRUM ANALYZER HARMONIC SPURIOUS AND NON-HARMONIC SPURIOUS CALIBRATION:

4.13.1 Repeat step 3.8. Select the TI Analyzers window and set **RF Freq** to *50.0* MHz. Press TI TEST key and select TI **Spectrum Analyzer** from floating window.

4.13.2 Connect RF Reference Source Ref Frequency Output to the TI EXT REF I/O (rear panel). Connect RF Reference Source Output to the TI ANT connector.

4.13.3 Set RF Reference Source, as required, for a 10 MHz reference output.

4.13.4 Press TI UTILS twice, *Hardware Settings*, *frequency reference*, **SELECT** then *external*. Press RETURN.

4.13.5 Set the TI **CF** to *50* MHz, **SPAN** to *3* MHz and **Ref Level** to *-30* dBm. Set Input to *ANT*.

4.13.6 Set the RF Reference Source for 50 MHz and an output level to -30 dBm.

4.13.7 Select TI Markers, Mkr1, Mkr1 and PK. Adjust the RF Reference Source output controls for a TI Marker amplitude indication of -30.0 dBm.

4.13.8 Set the TI **CF** to *100* MHz, as required.

4.13.9 On the TI, verify the signal at 100 MHz is ≤-55 dBc (≤-85 dBm on TI display).

4.13.10 On the TI, verify all other signals (non-harmonic spurious) on the screen are ≤-60 dBc (≤-90 dBm on TI display).

4.13.11 Set RF Reference Source output to minimum and disconnect test setup.

4.13.12 Set RF Reference Source, as required, to turn 10 MHz reference output off.

4.14 SPECTRUM ANALYZER THIRD ORDER INTERMODULATION CALIBRATION:

4.14.1 Repeat step 3.8. Select the TI Analyzers window and set **RF Freq** to *50.0* MHz. Press TI TEST key and select TI **Spectrum Analyzer** from floating window.

4.14.2 Connect equipment as shown in Figure 2.

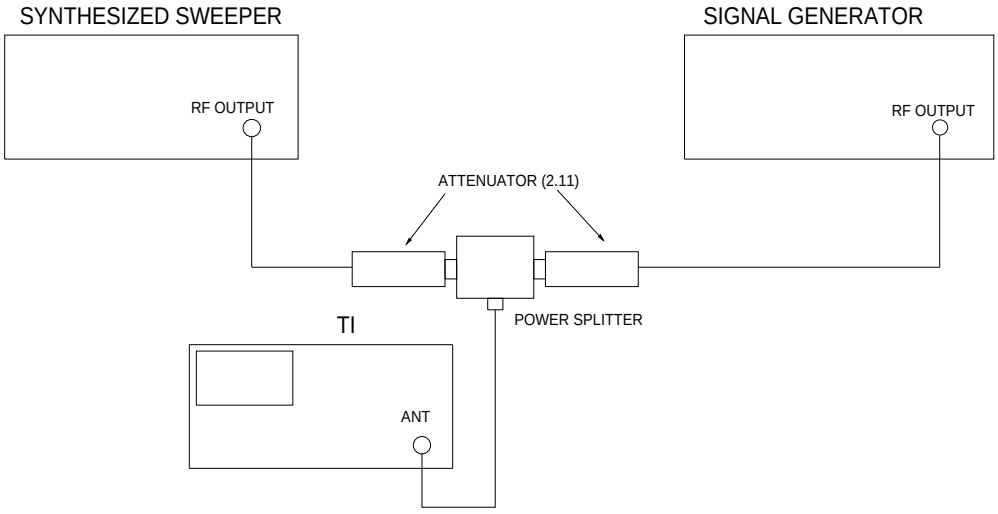

Figure 2.

4.14.3 Set the TI **SPAN** to *5* kHz, **Ref Level** to *-20* dBm, *RBW* to *300* Hz and *VBW* to *100* Hz. Set **RF In** to *ANT*. Set **CF** to *50* MHz, as required.

4.14.4 Set the Signal Generator for 50 MHz at -15 dBm.

4.14.5 Select TI Markers, Mkr1, Mkr1 and PK.

4.14.6 Adjust the Signal Generator level for a TI Marker amplitude indication of -30 dBm ±0.1 dB.

4.14.7 Set Signal Generator RF ON/OFF to OFF.

4.14.8 Set the Synthesized Sweeper for 50.1 MHz at -10 dBm.

4.14.9 Press TI **CF**, *Center*, then *50.1* MHz.

4.14.10 Select TI Markers, Mkr1, Mkr1 and PK.

4.14.11 Adjust the Synthesized Sweeper output controls for a TI Marker amplitude indication of -30 dBm ±0.1 dB.

4.14.12 Set the Signal Generator RF ON/OFF to ON.

4.14.13 Set the TI **CF**, *Center* then *50.2* MHz. Press **Ref Level** and set to *-30* dBm.

4.14.14 Select TI Markers, Mkr1, Mkr1 and PK. Record the TI Marker amplitude indication.

4.14.15 Press TI **CF**, then *49.9* MHz.

4.14.16 Select TI Markers, Mkr1, Mkr1 and PK. Record the TI Marker amplitude indication.

4.14.17 Verify the value recorded in step 4.14.14 minus -30 dBm is ≤-60 dB.

4.14.18 Verify the value recorded in step 4.14.16 minus -30 dBm is ≤-60 dB.

4.14.19 Set the Signal Generator and Synthesized Sweeper for minimum output. Disconnect test setup.

4.15 OSCILLOSCOPE VERTICAL CALIBRATION:

NOTE

The Active Head (p/o Oscilloscope Calibrator) is an integral part of the Oscilloscope Calibrator. All connections throughout the Calibration Process are to be made through the Active Head.

4.15.1 Repeat step 3.8.

4.15.2 Select the TI **Oscilloscope** window.

4.15.3 Connect the Oscilloscope Calibrator to the TI SCOPE CH1. Set the OUTPUT to ON, channel load to 1 MΩ and set for a 1 kHz squarewave output.

4.15.4 Set TI Trace A to **Channel 1**. Set Trigger to **Trace A**. Set **SWEEP** to *500 μs*. Set **COUPLING** to *DC*.

4.15.5 Set the TI **V/div** to the first value listed in the Range column of Table 16.

4.15.6 Set the Oscilloscope Calibrator amplitude to the first value listed in the Applied column of Table 16.

4.15.7 Adjust the Oscilloscope Calibrator output control for the amount of vertical display listed first in the Deflection column of Table 16.

4.15.8 Verify the Oscilloscope Calibrator indication is within the values listed in the Limits column of Table 16.

4.15.9 Repeat steps 4.15.5 through 4.15.8 for the remaining corresponding values listed in Table 16.

Table 16.

Range (Volts/Div)	Applied (V p-p)	Deflection (Div)	Limits (V p-p)
0.002	12 m	6	11.2 to 12.8 m
0.005	30 m	6	28 to 32 m
0.01	60 m	6	56 to 64 m
0.02	120 m	6	112 to 128 m
0.05	300 m	6	280 to 320 m
0.1	600 m	6	560 to 640 m
0.2	1.2	6	1.12 to 1.28
0.5	3	6	2.80 to 3.20
1	6	6	5.60 to 6.40
2	12	6	11.2 to 12.8
5	30	6	28.0 to 32.0
10	60	6	56.0 to 64.0
20	100	5	92 to 108

4.15.10 Set the Oscilloscope Calibrator OUTPUT to OFF.

4.15.11 Disconnect the Oscilloscope Calibrator from the TI SCOPE CH1 and connect to the TI SCOPE CH2. Set the Oscilloscope Calibrator amplitude to minimum and set the OUTPUT to ON.

4.15.12 Repeat steps 4.15.4 through 4.15.9, as required, for the TI SCOPE CH2.

4.15.13 Set the Oscilloscope Calibrator OUTPUT to OFF and disconnect test setup.

4.16 OSCILLOSCOPE BANDWIDTH CALIBRATION:

4.16.1 Repeat step 3.8.

4.16.2 Select the TI **Oscilloscope** window.

4.16.3 Connect the Oscilloscope Calibrator through the Feedthrough Termination to the TI SCOPE CH1.

4.16.4 Set the TI Trace A to **Channel 1**. Set **SWEEP** to *10 µs*. Set **COUPLING** to *AC*.

4.16.5 Set the TI Trigger to **Trace A**. Set **V/div** to *500mV*.

4.16.6 Set the Oscilloscope Calibrator for a 3 V p-p leveled sinewave signal into 50 Ω at 50 kHz. Set the OUTPUT to ON.

4.16.7 Adjust the Oscilloscope Calibrator output controls until the TI indication is as close as possible to 6 div and record the Oscilloscope Calibrator setting.

4.16.8 Set the TI **SWEEP** to *1 μs*.

4.16.9 Set the Oscilloscope Calibrator frequency to 4 MHz and adjust Oscilloscope Calibrator output amplitude to return TI display to 6 div and record the Oscilloscope Calibrator amplitude setting.

4.16.10 Calculate TI Bandwidth as follows:

$$BW = \left(\frac{50\ kHz\ Amplitude}{4\ MHz\ Amplitude}\right)\ LOG * 20$$

Where:

50 kHz Amplitude = the value recorded in step 4.16.7.

4 MHz Amplitude = the value recorded in step 4.16.9.

4.16.11 Verify the result of step 4.16.10 is <3 dB.

4.16.12 Set the Oscilloscope Calibrator OUTPUT to OFF.

4.16.13 Disconnect the Oscilloscope Calibrator and Feedthrough Termination from the TI CH 1 input connector and connect to the TI SCOPE CH 2 input connector.

4.16.14 Repeat step 4.16.4 through 4.16.12, as required, for the TI SCOPE CH2.

4.16.15 Disconnect the Oscilloscope Calibrator and Feedthrough Termination from the TI CH 2 input connector and connect to the TI SCOPE CH 1 input connector without the Feedthrough Termination.

4.17 OSCILLOSCOPE HORIZONTAL SWEEP CALIBRATION:

4.17.1 Set the TI **V/div** to *200 mV* and the CH1 Input Coupling to DC. Set the Oscilloscope Calibrator for squareware Time Marks at 1 V p-p into 1 MΩ. Set the Oscilloscope Calibrator OUTPUT to ON.

4.17.2 Set the TI **SWEEP** to the first value listed in the Range column of Table 17.

4.17.3 Set the Oscilloscope Calibrator marker output to the first value listed in the Applied column of Table 17.

4.17.4 Adjust the Oscilloscope Calibrator Time Marker controls to align the two on-screen markers over the center 8 div on the TI CRT.

4.17.5 Verify the Oscilloscope Calibrator indicates within the values listed in the Limits column of Table 17.

4.17.6 Repeat steps 4.17.2 through 4.17.5 for the remaining corresponding values listed in Table 17.

NOTE

Display may drift at slower sweep speeds. If necessary, set TI Trigger Auto to Normal to stabilize display.

Table 17.

Range (Sec/Div)	Applied	Limits
1 µs	1 µs	>0.85 to <1.15 µs
2 µs	2 µs	>1.70 to <2.30 µs
5 µs	5 µs	>4.25 to <5.75 µs
10 µs	10 µs	>8.5 to <11.5 µs
20 µs	20 µs	>17.0 to <23.0 µs
50 µs	50 µs	>42.5 to <57.5 µs
100 µs	100 µs	>85.0 to <115.0 µs
200 µs	200 µs	>170.0 to <230.0 µs
500 µs	500 µs	>425.0 to <575.0 µs
1 ms	1 ms	>0.85 to <1.15 ms
2 ms	2 ms	>1.70 to <2.30 ms
5 ms	5 ms	>4.25 to <5.75 ms
10 ms	10 ms	>8.5 to <11.5 ms
20 ms	20 ms	>17.0 to <23.0 ms
50 ms	50 ms	>42.5 to <57.5 ms
100 ms	100 ms	>85.0 to <115.0 ms
200 ms	200 ms	>170.0 to <230.0 ms
500 ms	500 ms	>425.0 to <575.0 ms
1 s	1 s	>0.85 to <1.15 s

4.17.7 Set the Oscilloscope Calibrator OUTPUT to OFF.

4.17.8 Set all outputs to minimum and disconnect test setup.

4.18 AUDIO FUNCTION GENERATOR AMPLITUDE AND SPECTRAL PURITY CALIBRATION:

4.18.1 Repeat step 3.8.

4.18.2 Connect equipment as shown in Figure 3.

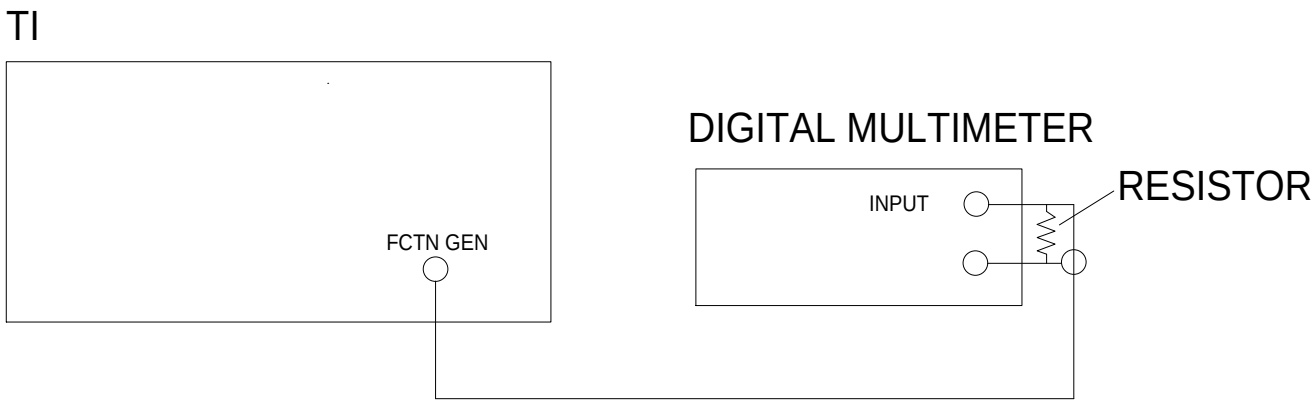

Figure 3.

4.18.3 Select TI **Generators** window.

4.18.4 Set the Digital Multimeter, as required, to measure ACV.

4.18.5 Set the TI **AF1 Frequency** to *1* kHz.

4.18.6 Set the TI **AF1 Amplitude** to the first value listed in the Applied column of Table 18.

4.18.7 Set TI Output Port to Function Generator and turn on by selecting **AF1** (**AF1** will turn green).

4.18.8 Verify the Digital Multimeter indication is within the first values listed in the Limits Amplitude column of Table 18.

4.18.9 Repeat steps 4.18.4 through 4.18.8 for the remaining values listed in Table 18.

4.18.10 Set the TI **AF1** to *OFF*.

4.18.11 Disconnect TI FCTN GEN and Resistor from the Digital Multimeter INPUT and connect it to the MMR AUDIO INPUT 100 kΩ connector.

4.18.12 Set the TI **AF1 Frequency** to *1* kHz.

4.18.13 Set the TI **AF1 Amplitude** to the first applicable value listed in the Applied column of Table 18.

4.18.14 Set TI Output Port to Function Generator and turn on by selecting **AF1** (**AF1** will turn green).

4.18.15 Set the MMR, as required, to measure the audio distortion.

4.18.16 Verify the MMR audio distortion indication is within the corresponding value listed in the Limits Audio Distortion column of Table 18.

4.18.17 Repeat steps 4.18.12 through 4.18.16 for the remaining applicable values listed in Table 18.

Table 18.

Applied (V rms)	Limits Amplitude (V rms)	Audio Distortion (%)
5	4.95000 to 5.05000	N/A
4	3.96000 to 4.04000	N/A
3	2.97000 to 3.03000	<0.5
2	1.98000 to 2.02000	<0.5
1	0.99000 to 1.01000	<0.5
0.5	0.49500 to 0.50500	<0.5
0.1	0.09900 to 0.10100	<0.5
0.05	0.04950 to 0.05050	N/A
0.001	0.00099 to 0.00101	N/A

4.18.18 Set the TI **AF1** to *OFF*.

4.18.19 Repeat steps 4.18.2 through 4.18.17 for TI **AF2**.

4.18.20 Set TI **AF2** to *OFF*.

4.18.21 Repeat steps 4.18.2 through 4.18.17 for TI **AF3**.

4.18.22 Set the TI **AF3** to *OFF* and disconnect test setup.

4.19 AUDIO FUNCTION GENERATORS FREQUENCY CALIBRATION:

4.19.1 Connect TI FCTN GEN to the Universal Counter CHANNEL 1 input connector.

4.19.2 Set TI **AF3** Amplitude to 1 V.

4.19.3 Set the TI **AF3** Frequency to the first value listed in the Freq column of Table 19. Set the TI **AF3** to ON.

4.19.4 Verify the Universal Counter indication is within the corresponding value listed in the Limits column of Table 19.

4.19.5 Repeat steps 4.19.3 and 4.19.4 for the remaining corresponding values listed in Table 19.

Table 19.

Freq (Hz)	Limits (Hz)
20	19.999 to 20.001
100	99.995 to 100.005
1 k	999.95 to 1000.05
10 k	9999.50 to 10000.50
20 k	19999.00 to 20001.00
40 k	39998.00 to 40002.00

4.19.6 Set the TI **AF3** to *OFF*. Set the TI **AF2** to *ON*.

4.19.7 Repeat steps 4.19.2 through 4.19.5 for **AF2**.

4.19.8 Set the TI **AF2** to *OFF*. Set the TI **AF1** to *ON*.

4.19.9 Repeat steps 4.19.2 through 4.19.5 for **AF1**.

4.19.10 Set the TI **AF1** to *OFF* and disconnect test setup.

4.20 DIGITAL MULTIMETER AC AND DC VOLTMETER CALIBRATION: (3920 OPT 053, 3920N OPT 053 and 3920B Only)

4.20.1 Repeat step 3.8. Select the TI Meters window then select **DMM**.

4.20.2 Connect the Multiproduct Calibrator NORMAL output to the TI DVM connector, observing polarity.

4.20.3 Set the TI **DVM Range** to the first value listed in the Range column of Table 20.

4.20.4 Set the Multiproduct Calibrator to the first values listed in the Frequency and Applied columns of Table 20. Set the Multiproduct Calibrator OPR/STBY key to OPR.

4.20.5 Verify the TI indication is within the values listed in the Limits column of Table 20. Set the Multiproduct Calibrator OPR/STBY key to STBY.

4.20.6 Repeat steps 4.20.3 through 4.20.5 for the remaining corresponding values listed in Table 20.

Table 20.

Range (VAC)	Frequency (kHz)	Applied (VAC)	Limits (V rms)
200 m	0.05	180 m	169.9 to 190.1 m
200 m	1	180 m	169.9 to 190.1 m
200 m	20	180 m	169.9 to 190.1 m
2	20	1.8	1.699 to 1.901
2	1	1.8	1.699 to 1.901
2	0.05	1.8	1.699 to 1.901
20	0.05	18	16.99 to 19.01
20	1	18	16.99 to 19.01
20	20	18	16.99 to 19.01
200	20	150	139.9 to 160.1
200	1	150	139.9 to 160.1
200	0.05	150	139.9 to 160.1

4.20.7 Set the TI **DVM** to *DC*.

4.20.8 Set the TI **DVM Range** to the first value listed in the Range column of Table 21.

4.20.9 Set the Multiproduct Calibrator to the first value listed in the Applied column of Table 21. Set the Multiproduct Calibrator OPR/STBY key to OPR.

4.20.10 Verify the TI indication is within the first values listed in the Limits column of Table 21. Set the Multiproduct Calibrator OPR/STBY key to STBY.

4.20.11 Repeat steps 4.20.8 through 4.20.10 for the remaining corresponding values listed in Table 21.

Table 21.

Range (VDC)	Applied (VDC)	Limits (VDC)
200 m	180 m	177.9 to 182.1 m
2	1.8	1.779 to 1.821
2	1.2	1.179 to 1.221
2	0.6	0.579 to 0.621
20	18	17.79 to 18.21
200	150	139.9 to 160.1

4.20.12 Disconnect test setup.

4.21 DIGITAL MULTIMETER AC AND DC AMMETER CALIBRATION: (3920 OPT 053, 3920N OPT 053 and 3920B Only)

4.21.1 Repeat step 3.8. Select the TI Meters window then select **DMM**.

4.21.2 Connect equipment as shown in Figure 4, using solid lines.

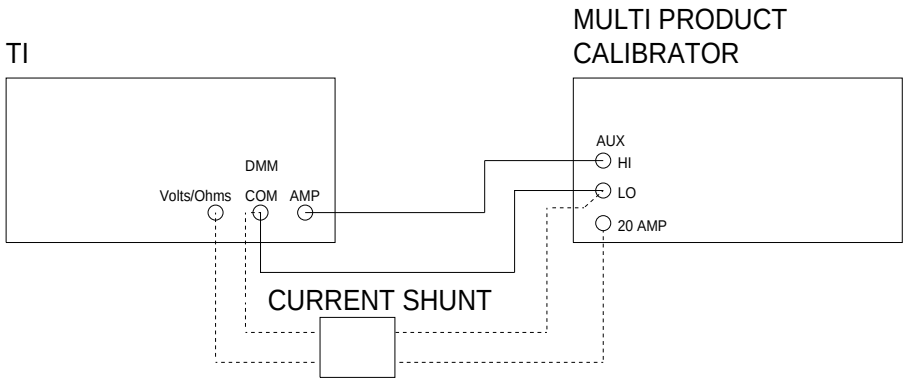

Figure 4.

4.21.3 Set TI **UNITS** to *DC AMP*, **SCALE** to *AUTO SCALE*, and set *Peak Hold* to *OFF*.

4.21.4 Set the TI *DC AMP* **Range** to the first value listed in the Range column of Table 22.

4.21.5 Set the Multiproduct Calibrator to the first values listed in the Applied column of Table 22. Set the Multiproduct Calibrator OPR/STBY key to OPR.

4.21.6 Verify the TI indication is within the values listed in the Limits column of Table 22. Set the Multiproduct Calibrator OPR/STBY key to STBY.

4.21.7 Repeat steps 4.21.4 through 4.21.6 for the remaining corresponding values listed in Table 22.

Table 22.

Range (ADC)	Applied (ADC)	Limits (ADC)
200 m	180 m	169.9 to 190.1 m
2	1.8	1.699 to 1.901
20 *	18	16.99 to 19.01

* Disconnect test setup. Connect equipment as shown in Figure 4, using dashed lines.

4.21.8 Disconnect test setup. Connect equipment as shown in Figure 4, using solid lines.

4.21.9 Press the TI Receiver key. Set TI **UNITS** to *ACA*, **SCALE** to *AUTO SCALE*, and set *Peak Hold* to *OFF*.

4.21.10 Set the TI **DVM Range** to the first value listed in the Range column of Table 23.

4.21.11 Set the Multiproduct Calibrator to the first values listed in the Frequency and Applied columns of Table 23. Set the Multiproduct Calibrator OPR/STBY key to OPR.

4.21.12 Verify the TI indication is within the first values listed in the Limits column of Table 23. Set the Multiproduct Calibrator OPR/STBY key to STBY.

4.21.13 Repeat steps 4.21.10 through 4.21.12 for the remaining corresponding values listed in Table 23.

Table 23.

Range (AAC)	Frequency (Hz)	Applied (AAC)	Limits (AAC)
200 m	60	180 m	169.9 to 190.1 m
200 m	10 k	180 m	169.9 to 190.1 m
2	60	1.8	1.699 to 1.901
2	10 k	1.8	1.699 to 1.901
20 *	60	18	16.99 to 19.01
20	5 k	18	16.99 to 19.01

* Disconnect test setup. Connect equipment as shown in Figure 4, using dashed lines.

4.21.14 Disconnect test setup.

4.22 DIGITAL MULTIMETER OHMMETER CALIBRATION: (3920 OPT 053, 3920N OPT 053 and 3920B Only)

4.22.1 Repeat step 3.8. Select the TI Meters window then select **DMM**.

4.22.2 Connect the Multiproduct Calibrator NORMAL output to the TI Ohm connector observing polarity.

4.22.3 Set TI **Units** to Ohm, **Scale** to first value listed in the Range column of Table 24, and set ***Pk Hold*** to *OFF*.

4.22.4 Set the Multiproduct Calibrator to the first value listed in the Applied column of Table 24. Set the Multiproduct Calibrator OPR/STBY key to OPR.

4.22.5 Verify the TI indication is within the first values listed in the Limits column of Table 24. Set the Multiproduct Calibrator OPR/STBY key to STBY.

4.22.6 Repeat steps 4.22.4 and 4.22.5 for the remaining values listed in Table 24.

Table 24.

Range (Ω)	Applied (Ω)	Limits (Ω)
200	180	169.9 to 190.1
2 k	1.8 k	1.699 to 1.901 k
20 k	18 k	16.99 to 19.01 k
200 k	180 k	169.9 to 190.1 k
2 M	1.8 M	1.699 to 1.901 M
20 M	18 M	16.99 to 19.01 M

4.22.7 Set all POWER switches to OFF or STBY. Disconnect and secure all equipment.

4.22.8 Annotate and attach a Limited Certification Label as per steps 3.13, 3.14, 3.15 and 3.16 as applicable.

CALIBRATION PERFORMANCE TABLE

Not Required

APPENDIX A

A-1 TIME BASE ADJUSTMENT:

NOTE

The 3900 Series Calibration Adjustment Subsystem is only available if Calibration Option 390XOPT040 is installed. Verify Option 390XOPT040 is installed in step 3.8 prior to performing adjustment procedure.

A-1.1 Connect Frequency Standard 10 MHz REF OUT to the Universal Counter Ref In.

A-1.2 Set the Universal Counter channel 1 to DC coupling, 50 Ω input impedance, and auto trigger.

A-1.3 Press TI CONFIG twice, then **System - Calibration**.

A-1.4 Using TI rotary knob, scroll down to **TCXO Adjustment**. Press the TI SELECT. Verify box to the left of TCXO Adjustment is green and no other boxes are green. Press TI Run Selected.

NOTE

Disregard connection diagram on TI display.

A-1.5 Connect TI EXT REF IO (rear panel) to the Universal Counter CHANNEL 1 Input. Press TI Continue.

A-1.6 Using TI rotary knob, adjust DAC value for Universal Counter indication of 10 MHz +/- 0.02 Hz. Press TI Done when complete. Press TI Continue to return to Calibration screen.

A-1.7 Press TI CONFIG, then **System - Analog Duplex** to return to normal operation.